the differences between the disclosed embodiments and the prior art subject matter, do not define the scope or interpretation of any of the claims. Instead, such discussed differences merely help the Examiner appreciate important claim distinctions discussed thereafter.

The disclosed embodiments of the present invention are generally directed to various apparatuses and to methods for testing and assembling bumped devices using an anisotropically conductive layer. In a pertinent embodiment, a semiconductor device includes a surface having a plurality of conductive bumps formed on the surface, a substrate having a plurality of substantially flat contact pads distributed thereon and in approximate alignment with the plurality of conductive bumps, and an anisotropically conductive layer disposed between the bumped device and the substrate that electrically couples each of the conductive bumps with a corresponding bond pads, thus providing electrical contact between the conductive bumps and the contact pads. Accordingly, the anisotropic layer advantageously permits electrical contact between the conductive bumps and the contact pads despite physical variations in the conductive bump height.

The disclosed embodiment thus permits test signals to be transmitted to and to be received from the bumped device through the metallic contact pads via the anisotropically conductive layer. After the bumped device has been tested, it may be conveniently disengaged from the substrate by simply moving the conductive bumps away from the flexible outer surface of the anisotropically conductive layer.

In another particular embodiment of the present invention, the contact pads are located within pockets formed in the substrate and the anisotropically conductive material is disposed within the pockets. In order to form the electrically conductive contact between the bumps and the contact pads, the bumps are positioned within the pockets formed in the substrate. Thus, the pockets are located at predetermined positions in the testing substrate to receive a device with a corresponding configuration of conductive bumps. This advantageously permits the device containing conductive bumps to be easily aligned with, inserted into, and removed from electrical contact with the pads in the test device, so that one test device with one configuration of pockets may easily be used to test multiple devices containing the proper configuration of bumps.

As noted above, the substrate having the anisotropically conductive layer with the flexible outer surface may advantageously improve the process of testing of the bumped device by reducing or eliminating the time and effort involved in detaching the conductive bumps from the anisotropically conductive layer. Because the conductive bumps are not embedded in the layer, it is not necessary to reheat the apparatus to the rework temperature of the anisotropically conductive layer in order to disengage the bumped device from the substrate. The time, effort, and expense associated with disengaging the conductive bumps from the anisotropically conductive layer may therefore be reduced or eliminated.

Similarly, because the conductive bumps are not embedded in the anisotropically conductive layer, the time, effort, and expense associated with cleanup of any residual anisotropically conductive material deposited on the conductive bumps may also be reduced or eliminated. Depending upon the anisotropically conductive material used, the transfer of material to the conductive bumps may be minimized or eliminated so that the conductive bumps may be clean enough for immediate use after testing.

The Examiner has cited the Sako reference as pertinent to the patentability of claims in the present application. Sako discloses a method for mounting an integrated circuit flip chip having bumps by engaging a substrate using an anisotropically conductive film (ACF) in combination with an adhesive paste that may optionally also be anisotropically conductive. With reference to Figure 1, an IC chip 1 having bumps 2 is positioned on an ACF 4 that is supported by a substrate 5. A paste-like adhesive 3 is disposed between the IC chip 1 and the ACF 4. The paste-like adhesive may be anisotropically conductive, but may also not be anisotropically conductive in certain embodiments. The Examiner is directed to col. 9, line 7, and col. 10, lines 6-8 of the Sako reference for this disclosure.

Referring now to Figure 2 of the Sako reference, the paste-like adhesive 3 and the ACF 4 are deformed by a pressure applied to the IC chip 1 in an area adjacent to the bumps 2. Accordingly, the paste-like adhesive 3 and the ACF 4 that are positioned below the bumps 2 increase their fluidity when heat is applied as a part of the heat bonding process, to form a mixed region 8 comprised of the ACF 4 and the paste-like adhesive 3. Thus, electrical conductivity between the IC chip 1 and the substrate 5 is formed by through the mixed region 8. The Examiner is directed to col. 7, lines 10-40 for this disclosure.

Applicants note that Sako does not disclose metallic contact pads positioned within a pocket, and further notes that Sako fails to disclose metallic contact pads at all. The Examiner has nevertheless characterized the disclosed mixed region 8 as shown in Figure 2 as anticipating the contact pads as disclosed in various embodiments of the present invention. However, as noted above, the mixed region 8 is formed from the ACF 4 and the paste-like adhesive through the application of heat and pressure to the IC chip 1.

Turning now to the specific language of the claims, patentable differences between the claim language and the applied art will be specifically pointed out. Claim 1, as amended, recites in pertinent part, "A semiconductor device, comprising...a bumped device having a plurality of conductive bumps formed thereon...a substrate having a plurality of pockets disposed therein *and a plurality of metallic contact pads distributed thereon*..."(Emphasis added). Sako does not disclose the use of metallic contact pads. Instead, Sako discloses the formation of a mixed region proximate to the bumps, the mixed region being comprised of the ACF and the paste-like adhesive, and formed when heat and pressure are applied to the assembly. Claim 1 is therefore allowable over the Sako reference. Further, claims depending from claim 1 are similarly allowable, based upon the allowability of the base claim and further in view of the additional limitations recited in the dependent claims.

Claim 9, as amended, recites in pertinent part: "An apparatus for testing a bumped device having a plurality of conductive bumps, comprising...a substrate including a first surface having a plurality of pockets disposed therein *and a plurality of metallic contact pads distributed thereon*..." (Emphasis added). Again, the Sako reference simply does not disclose this. Instead, the paste and the ACF are used to form the conductive element between the IC chip and the substrate. Claim 9 is therefore also in allowable form. Claims depending from claim 9 are similarly allowable based upon the allowable form of claim 9 and further in view of the additional limitations recited in the dependent claims.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "**Version with Markings to Show Changes Made**".

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,

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